



Energy Efficiency and Renewable Energy
Federal Energy Management Program

How to Buy an Energy-Efficient Distribution Transformer

Why Agencies Should Buy Efficient Products

- Executive Order 13123 and FAR section 23.704 direct agencies to purchase products in the upper 25% of energy efficiency, including all models that qualify for the EPA/DOE ENERGY STAR® product labeling program.
- Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.
- As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy efficiency, while saving taxpayer dollars.

Federal Supply Sources:

- General Services Administration (GSA)
Phone: (817) 978-8421

For More Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-efficient federal procurement, including the latest versions of these recommendations.
Phone: (800) 363-3732
www.eren.doe.gov/femp/procurement
- Environmental Protection Agency (EPA) has ENERGY STAR® product listings. EPA also provides computer software that performs cost-effectiveness analyses for transformers.
Phone: (888) 782-7937
www.energystar.gov
- National Electrical Manufacturers Association (NEMA) publishes Standards Publication TP-1-1996, *Guide for Determining Energy Efficiency for Distribution Transformers*.
Phone: (800) 854-7179
www.nema.org
- Consortium for Energy Efficiency (CEE) provides information on utility programs promoting low-voltage transformers that meet these efficiency levels.
Phone: (617) 589-3949
www.ceeformt.org
- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation.
Phone: (202) 646-7950

Efficiency Recommendation

Single Phase Percent Efficiency			
Rated Capacity (kVA)	Low Voltage	Medium Voltage	
	Recommended Level	Recommended Level (Dry)	Recommended Level (Liquid)
10	–	–	98.3 or more
15	97.7 or more	97.6 or more	98.5 or more
25	98.0 or more	97.9 or more	98.7 or more
37.5	98.2 or more	98.1 or more	98.8 or more
50	98.3 or more	98.2 or more	98.9 or more
75	98.5 or more	98.4 or more	99.0 or more
100	98.6 or more	98.5 or more	99.0 or more
167	98.7 or more	98.7 or more	99.1 or more
250	98.8 or more	98.8 or more	99.2 or more
333	98.9 or more	98.9 or more	99.2 or more
500	–	99.0 or more	99.3 or more
667	–	99.0 or more	99.4 or more
833	–	99.1 or more	99.4 or more
Three Phase Percent Efficiency			
15	97.0 or more	96.8 or more	98.0 or more
30	97.5 or more	97.3 or more	98.3 or more
45	97.7 or more	97.6 or more	98.5 or more
75	98.0 or more	97.9 or more	98.7 or more
112.5	98.2 or more	98.1 or more	98.8 or more
150	98.3 or more	98.2 or more	98.9 or more
225	98.5 or more	98.4 or more	99.0 or more
300	98.6 or more	98.5 or more	99.0 or more
500	98.7 or more	98.7 or more	99.1 or more
750	98.8 or more	98.8 or more	99.2 or more
1000	98.9 or more	98.9 or more	99.2 or more
1500	–	99.0 or more	99.3 or more
2000	–	99.0 or more	99.4 or more
2500	–	99.1 or more	99.4 or more

Definitions

Energy efficiency of distribution transformers is defined by NEMA's Standards Publication TP-1 (see "For More Information") as output kVA divided by the sum of output kVA plus losses, at a specified percent load and reference temperature.

Low voltage transformers have a primary voltage of 1200 volts or less; efficiency is measured at 35% of nameplate load, at 75°C.

Medium voltage transformers have a primary voltage greater than 1200 volts; efficiency is measured at 50% of nameplate load, at 75°C for dry-type transformers and 85°C for liquid-filled.

Liquid-filled transformers typically use oil as a combination coolant and insulating medium. They are generally higher in efficiency, but are most frequently installed outside.

The federal supply source for energy-efficient distribution transformers is the General Services Administration (GSA). GSA offers transformers through Schedule 61-V(B), "Power Distribution Equipment." Whether you buy from GSA or use a commercial supplier or contractor (e.g., an A&E firm), be sure to specify a transformer that meets the Efficiency Recommendation for that capacity and type.

The efficiency levels in this Recommendation are the same as those in NEMA's TP-1 standard. The Consortium for Energy Efficiency (CEE) and the EPA/DOE ENERGY STAR program identify low-voltage distribution transformers that meet the efficiency criteria specified in this Recommendation and TP-1 (see "For More Information").

Where To Find Energy-Efficient Distribution Transformers



Safety codes require that indoor transformer installations meet stringent fire-protection and spill containment conditions. Some "less-flammable liquid-filled" transformers can meet code requirements for indoor uses when applicable fire protection and spill containment conditions are met.

Buyer Tips

Many types of modern office equipment and devices (personal computers, printers, copiers, fax machines, electronic lighting ballasts) and some industrial equipment (adjustable speed motor drives) impose non-linear loads, which can introduce power wave form distortion. If your transformer serves equipment such as these, consider using a "K-rated" or "drive isolation" transformer designed for specific types of non-linear loads. Simply replacing an existing transformer with a standard unit rated at a higher kVA level is generally not a good approach for these applications. Both first cost and operating cost are frequently higher with larger capacity standard units, which are not designed to accommodate harmonics and other problems imposed by non-linear loads.

Transformer Cost-Effectiveness Examples

1500 kVA, Three Phase, Medium Voltage Dry-Type

Performance	Base Model	Recommended Level
Efficiency	98.6%	99.0%
Annual Energy Loss	91,380 kWh	66,360 kWh
Annual Energy Loss Cost	\$5,480	\$3,980
Lifetime Energy Loss Cost	\$81,300	\$59,000
Lifetime Energy Cost Savings	-	\$22,300

25 kVA, Single Phase, Low Voltage

Efficiency	96.7%	98.0%
Annual Energy Loss	2,600 kWh	1,570 kWh
Annual Energy Loss Cost	\$156	\$94
Lifetime Energy Loss Cost	\$2,300	\$1,400
Lifetime Energy Cost Savings	-	\$900

Definitions

Annual Energy Loss is based on 50% of nameplate load in the medium voltage example (top), and 35% of nameplate load in the low voltage example (bottom).

Lifetime Energy Cost Savings is the sum of the discounted value of annual energy cost savings, based on average usage and an assumed transformer life of 25 years. Future electricity price trends and a discount rate of 3.4% are based on federal guidelines (effective from April, 2000 to March, 2001). The assumed electricity price is 6¢/kWh, the federal average electricity price in the U.S.

Using the Cost-Effectiveness Table

In the example shown above, a 1500 kVA, three phase, medium voltage transformer at the Recommended efficiency level of 99.0% is cost-effective if its purchase price is no more than \$22,300 above the price of the Base Model. Similarly in the 25 kVA, single phase, low voltage example, the Recommended model, with an efficiency of 98.0%, is cost-effective if its purchase price is no more than \$900 above the price of the Base Model.

EPA provides software to assist in evaluating the cost-effectiveness of transformers for both new and replacement applications (see "For More Information").

